



NASA Sustainability Success Stories

Government and industry alike have placed an increasing focus on operations involving the stewardship of the Earth's natural resources. These include reducing the use of fossil fuels, conserving energy and water, and committing to sustainable practices in conducting daily operations. NASA's sustainability policy is to execute NASA's mission without compromising our planet's resources, so future generations can meet their needs. Sustainability also involves taking action now, to provide a future where the environment and living conditions are protected and enhanced. In October 2009, President Obama signed Executive Order (EO) 13514, outlining new requirements for reducing greenhouse gases and developing sustainable buildings. The EO also required federal government agencies to submit, to the Office of Management and Budget, a Strategic Sustainability Performance Plan (SSPP). NASA's SSPP was published in September 2010 and is updated annually. This fact sheet provides some examples of the many areas in which NASA is playing a leading role in developing federal government sustainability plans and practices.

NASA Receives GreenGov Presidential Award

NASA has been honored by the White House for its ongoing commitment to environmental sustainability. The Agency was given a GreenGov Presidential Award by the White House Council on Environmental Quality, celebrating extraordinary federal sustainability achievements. NASA received the Lean, Clean and Green Award for setting exemplary goals in Agency-wide energy and water efficiency, reduced emissions and greater renewable energy usage. Several NASA sustainability solutions also address the communities in which its facilities are located. NASA's commitment is exemplified by the NASA Centers (Langley, Ames, Kennedy and Johnson, among others), which have addressed sustainability with creative, lasting and effective methods - including green building design and construction.

Taking the Lead – on LEED

NASA is employing space technologies to create technical innovations on Planet Earth. First utilized in remote and confined locations for humans in space exploration, these innovations are evident in NASA's commitment to design, construct and operate buildings using much less energy and water than buildings of comparable size. In June 2011, NASA received what is termed a LEED Platinum rating (the highest given) at the ribbon cutting for the new Building 2101 now serving as headquarters for the Langley Research Center (LaRC) in Virginia. Also known as New Town, Phase 1, the 79,000 square foot building provides workspace for 260 employees, and is part of a major development plan on the LaRC campus. Platinum is the highest of four LEED (Leadership in Energy and Environmental Design) ratings - the others, in ascending order, are Certified, Silver and Gold. This internationally recognized green building certification system is governed by the non-profit U.S. Green Building Council. LEED uses a point scale to quantify sustainable building features - such as water and energy efficiency, and environmentally friendly materials. Building 2101 was designed for Gold, but several of its features yielded enough points to earn Platinum. Building 2101 includes: a "green roof" to reduce energy costs and absorb rainwater for re-use, and a geothermal "ground source" heating and cooling system that employs 90 deep wells and saves 25-50% on HVAC energy. NASA first received Platinum in 2010 for an office building (Building 57) at the Johnson Space Center in Texas, designed to be 57% more energy efficient than the typical office building.



The ARC Collaborative Research Support Facility (a.k.a. Sustainability Base) has a curved shape, designed to resemble the Moon.

Two other NASA facilities, at the Kennedy Space Center (KSC) in Florida and Ames Research Center (ARC) in California, are in line for LEED Platinum. In January 2011, NASA opened the Propellants North Administration and Maintenance Facility at KSC. Its two buildings produce enough energy from renewable sources (including a solar panel system on the roof) to offset what the building requires to operate. In late 2011, NASA is expected to open the ARC's Collaborative Research Support Facility (a.k.a. "Sustainability Base"). The lunar-shaped building has several components originally engineered for space travel. They include a "forward osmosis" treatment system - taking water from restroom sinks and showers and reusing it to flush toilets. The building will use 75% less energy and 90% less potable water (for human consumption) than similar-sized structures.

Other features include: Floor-to-ceiling windows, to limit artificial lighting use to about 40 workdays a year

Rooftop solar panels, eventually to be augmented by a solid oxide fuel cell

A geothermal system (to provide cool air to workspaces) containing 100 wells, and a pump that runs cool water through tubes into ceiling panels.

The Collaborative Research Support Facility is described as, potentially, the "greenest," highest performing, building in the federal government - befitting the pending LEED Platinum rating. "Collaborative" can also refer to the partnership between NASA and the U.S. Department of Energy (DOE) Lawrence Berkeley National Laboratory in Berkeley, CA. The building's "smart system" technologies are being installed by NASA Ames engineers. Then, the Berkeley Lab will help integrate these technologies during the building's operation by means of the performance simulation model it developed to optimize energy operations. The Berkeley Lab's expertise in building technologies, systems and tools will help maximize the building's energy performance and will also enable NASA to potentially apply building control systems that can be applied to future space habitat systems.

NASA's vision for sustainable building design and construction took root in 2003, with the issuance of policy requirements for new design and construction: that all new buildings meet a minimum LEED Silver rating. In addition to the two LEED platinum ratings (soon to be four), seven NASA buildings have achieved Gold (two in 2009, five in 2010) and seven more Silver (the first in 2006). Executive Order 13514, signed in 2009, commits the federal government to achieve a LEED certification on all new buildings. By seizing the initiative on developing sustainable buildings years ago, NASA has clearly taken the lead on LEED - and on other federal sustainability efforts. ■



An overhead view of the KSC Propellants North Facility, which is a Net Zero facility awaiting LEED Platinum status.

Net Zero Design Yields Positive Results

"Net zero" is used to describe a building designed to provide as much of a resource as it consumes, such as energy or water. Under Executive Order 13514, all federal buildings in the planning process as of 2020 or later must be designed to meet net zero standards by 2030. NASA met this test with the construction and operation of the Propellants North Facility at the Kennedy Space Center (KSC).



Workers install solar panels on the roof of the KSC Propellants North Facility.

Net zero, and low utilization, design has become a NASA priority. Propellants North is NASA's first such facility, consisting of an 1,800-square foot shop and storage building, and a 9,450-square foot administration building, first occupied in January 2011. It meets net zero standards for both energy and water, a major factor in the facility earning a LEED Platinum rating. Its roof contains 300 solar panels (expected to generate 150 megawatt hours of energy per year) as well as the following:

A rainwater harvesting system. The roof is made of recycled materials, designed to absorb rainwater, which is then captured underground in three 25,000 gallon tanks. This provides water for flushing toilets inside the facility and irrigation for plants outside.

High windows with solar orientation that makes the most of natural daylight

A high efficiency air conditioning system, employing a thermostat, regulates both temperature and relative humidity at five feet above the ground

Heavily insulated walls and roofing

Light fixtures with sophisticated controls, including dimmers and room occupancy sensors

Meters, sensors and fans are also keys to NASA's net zero success. Sophisticated meters are essential for measuring the actual amounts of electricity and water used, to ensure designs are yielding actual results. Sensors are essential not only to the effectiveness of lighting and temperature controls but also to energy consumed by computers (even in the sleep mode) and telephones. Even fans have taken on an increasingly important role - especially at the Goddard Space Flight Center in Maryland, where the Exploration Sciences Building (a.k.a. Building 34) was opened in 2009. Building 34 is NASA's 10th sustainable facility, and the first containing both laboratory (over 60,000 square feet in 70 separate spaces) and office areas. The building was planned with the use of its workspace - and needs of building occupants - in mind. It was designed to reduce annual energy use by 20% (\$30,000 in annual savings) compared with similar buildings. Its highly efficient exhaust and ventilation system includes:

Four large, centralized rooftop fans, to vent hazardous exhaust from 70 lab spaces

HVAC fans set to varying velocities as necessary, instead of operating constantly or at high speed (per traditional systems)

NASA is committed to establishing design and construction benchmarks, and sharing information, among all of its Centers. The Agency is therefore working with a wide variety of groups, ranging from the American Society of Heating, Refrigerating and Air Conditioning Engineers to the U.S. Department of Energy's National Renewable Energy Laboratory. Through internal design and external collaboration, net zero planning will continue to yield positive results for future building design and construction. ■

Leveraging Existing Data Bases & Sharing Information

A Foundation for NASA Greenhouse Gas Reductions

NASA recognizes the important role that sustainable practices serve in supporting the Agency's mission, reducing costs and protecting the environment. NASA's efforts to reduce Greenhouse Gas (GHG) emissions are a good example. Early on, NASA recognized the relationship between energy use and GHG: the less energy used, the lower the emissions. In Fiscal Year (FY) 2008, NASA proactively expanded its existing Toxic and Chemical Management Plan to include GHG emissions (such as carbon dioxide) linked to documented energy use data from NASA operations. NASA then became one of the first federal agencies to implement an annual tracking system to estimate GHG emissions. The Agency utilized the NASA Environmental Tracking System (NETS) to track energy and transportation fuel use at each of its Centers nationwide, and incorporated data from the U.S. Department of Energy into its GHG calculations.

NASA subsequently shared the NETS tracking and analysis tool with the "Federal family" of agencies, to help support their sustainable operations. NASA updates its GHG inventory annually and has been proactive in supporting interagency efforts to estimate and track GHG emission levels. The robust database developed in FY 2008 helped NASA establish voluntary Agency reduction goals under Executive Order (EO) 13514 and were part of NASA's Strategic Sustainability Performance Plan (SSPP). The SSPP identifies three major emissions reduction targets, referred to as Scope 1, 2 and 3, to be met by FY 2020 (using FY 2008 data as a baseline) as illustrated in the accompanying chart

NASA is on track to meet its GHG reduction goals. A key to this progress is continued use of NETS, a system that provides annual, Agency-wide summary reports. NETS also helps NASA produce bi-annual scorecards to evaluate NASA's sustainability and energy performance. NASA and other federal agencies submit these scorecards to the Office of Management and Budget, as required by EO 13514. NASA remains proactive in its efforts to identify and reduce GHG emissions, utilizing data it has collected from communicating with employees at Headquarters and all NASA Centers. In 2010, NASA conducted its first Agency-wide commuting survey, to better characterize how employees commute to work and telecommute from home. NASA has integrated survey results, along with evolving GHG and energy requirements, into its sustainability planning, and continues to update the supporting data base to meet new requirements and inform Agency decision makers. NASA will also continue to integrate emission reductions strategies into mission activities, including those related to energy and transportation management. ■

